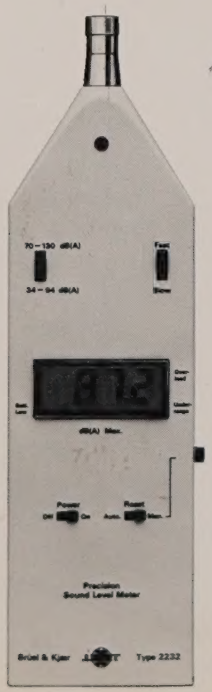
2232

Instruction Manual

Precision Sound Level Meter Type 2232



An easy to use, precision-class instrument with digital display, measuring max. RMS sound pressure level. The Type 2232 has built-in A-weighting network and "Fast" and "Slow" RMS detector characteristics. Two measurement modes allow either the max. RMS value to be updated and displayed every second or a "max. hold" reading to be obtained. A DC ouput which is proportional to the continuous A-weighted "Fast" or "Slow" RMS sound pressure level is provided for use with the Portable Graphic Level Recorder Type 2306. The Type 2232 fulfils the requirements of IEC 651 Type 1, DIN 45 633 Part 1 and ANSI S 1.4 Type S1A (and proposed revision).

Brüel & Kjær

1-033 0685-1A

Precision Sound Level Meter
Type 2232

From serial No. 865 786

November 1981

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Precision Sound Level Meter

USES:

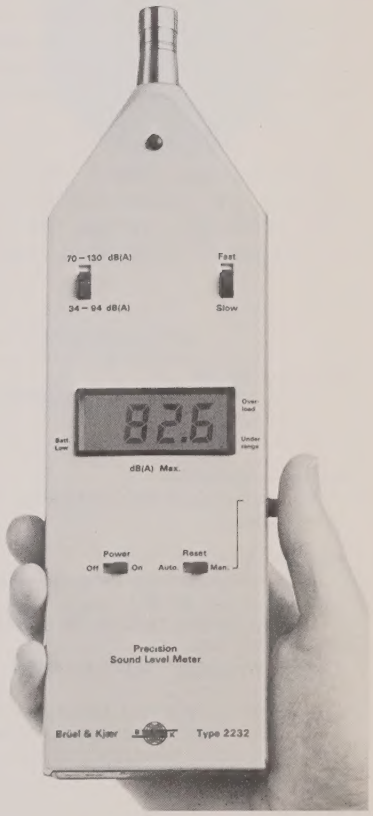
- Community and industrial noise measurements
- Checking compliance with noise rating recommendations
- Traffic noise measurements

FEATURES:

- Ease of operation
- Light weight (460 g)
- Measuring range from 34 to 130 dB(A)
- Type 1. precision
- "Fast" and "Slow" detector response in accordance with IEC 651 Type 1
- Built in A-weighting network
- Equipped with a robust, high sensitivity prepolarized condenser microphone
- Automatic and manual display-reset modes
- Large easily-read digital display
- DC output for Level Recorder

The Precision Sound Level Meter Type 2232 is a truly portable instrument that combines simplicity of operation with Type 1. precision. The Type 2232 is eminently suitable for noise investigations, checking compliance with permissible noise levels, measurements of traffic noise, and other applications where both expert and non-expert staff need to carry out acoustic measurements.

The Type 2232 complies with IEC 651 Type 1, DIN 45 633 Part 1 and ANSI S 1.4 Type S1A (and proposed revision).



Introduction

Precision Sound Level Meter Type 2232 is an inexpensive instrument, primarily designed for community noise surveys and less demanding acoustic measurements, which nevertheless offers the accuracy and quality associated with a precision-grade sound level meter. Its excellent ergonomic design and ease of operation enable even the inexperienced user to quickly and effectively carry out reliable measurements. The handy convenience of a Type 1 precision sound level meter which can be carried around in the pocket will be appreciated by all users. A large, easily-read digital display gives a single value indication of the maximum A-weighted RMS sound pressure level measured during the previous second, thereby eliminating meter reading errors. The Type 2232 is robust, compact and lightweight (460 g), and is the ideal tool for environmental health inspectors and other personnel concerned with maintaining acceptable noise levels in industrial and residential locations.

The Sound Level Meter satisfies the requirements of IEC 651 Type 1, DIN 45 633 Part 1, and ANSI S 1.4 Type S1A (and proposed revision), the latter when fitted with the Random Incidence Corrector DZ 9566 which is supplied as an accessory.

Description

The Sound Level Meter consists basically of a microphone, an amplifier and detector with associated

Fig. 1 Community noise measurements using the handy Type 2232

frequency and time weighting circuits, an analogue DC output, and a digital display. Overload, underrange and low battery indications are also provided. These conditions are displayed as shown in Fig. 2.

The Type 2232 is equipped with a high sensitivity B & K Prepolarized Condenser Microphone Type 4176 which was developed especially for use with the Sound Level Meter. The non-removable protection grid is internally fitted with a fine gauze filter which provides excellent immunity from dust and particle penetration to the diaphragm.

Measurements from 34 to 130 dB(A) are carried out in two 60 dB measuring ranges: 34 to 94 dB(A) and 70 to 130 dB(A). "Fast" or "Slow" detector averaging times may be selected in accordance with IEC 651. Two display-reset modes allow either a "max. hold" reading to be displayed or automatic resetting every second. In the automatic mode the max. RMS sound pressure level measured during the preceeding 1 s is displayed. When the manual display-reset mode is selected, the display shows the max. RMS value measured since the last manual reset. A continuous analogue DC output, which is proportional to the A-weighted "Fast" or "Slow" RMS sound pressure level, is provided for connection to a level recorder such as the Portable Graphic Level Recorder Type 2306.

The Type 2232 is powered from two 9 V, preferably alkaline, batteries (IEC type 6LF 22) which, from new, will provide approximately 30 hours continuous operation. When the instrument is first switched on, the display momentarily shows "BAT 188.8 ⇕", allowing a quick check of all display functions (Fig. 2).

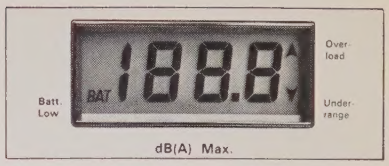


Fig. 2 Display function check shown when the Type 2232 is first switched on

Calibration of the Type 2232 is easily carried out using an external reference source such as the Sound Level Calibrator Type 4230, available as an accessory.

Specifications 2232

Measuring Range:
34 dB(A) to 130 dB(A) in two 60 dB ranges:
34 to 94 dB(A)
70 to 130 dB(A)

Frequency Response:
In accordance with IEC 651 Type 1.
A-weighting

Dectector:
Characteristics: RMS indication in accordance with IEC 651, Type 1
Dynamic Range: 70 dB (60 dB on scale plus 10 dB over)
Time Weighting: "Fast" and "Slow" to IEC 651, Type 1
Crest Factor: 10 dB (c.f. 3) at upper limit of display range, rising linearly with decreasing signal level to a maximum of 26 dB (c.f. 20)

Display:
3½ digit liquid crystal display with 0,1 dB display resolution. Overload, underrange and low battery warning
Read Out Interval: Updated once per second
Display Reset: "Auto." resets once per second and displays max. RMS value measured during the previous 1 s. "Man." resets when the reset button is pressed and displays max. RMS value measured since last reset

DC Output:
Proportional to continuous A-weighted "Fast" or "Slow" RMS sound pressure level
Output Impedance: <10 Ω
Nominal Output Voltage: 50 mV/dB (actual input) ±3 % (0 to 3 V in both measuring ranges)
Offset: 7 mV ±15 mV
Minimum Load Impedance: 10 kΩ

Microphone:
Type: B & K Half-inch Prepolarized Condenser Microphone Type 4176
Sensitivity: 50 mV/Pa (–26 dB re. 1 V/Pa)
Cartridge Capacitance: 13 pF

Effect of Windscreen:
<0,5 dB up to 10 kHz

Calibration:
Trimmer adjustment using Sound Level Calibrator Type 4230

Calibration Reference Conditions
Sound Field: Free Field Condition
Reference Incidence Direction: Perpendicular to microphone diaphragm (0° incidence)
Reference Sound Pressure Level: 94 dB re. 20 μPa
Reference Frequency: 1000 Hz
Reference Temperature: 20 °C
Reference Measuring Range: 70 to 130 dB(A)

Warm-up Time:
4 s

Effect of Ambient Temperature (at 1 kHz):
Operating Temperature Range: –10 to +50 °C (+14 to +122 °F). Sensitivity variation of complete sound level meter <0,5 dB (re. 20 °C)
Microphone Temperature Coefficient: –0,004 dB/°C
Storage Temperature Range: –20 °C to +70 °C (–4 to +158 °F) with batteries removed

Effect of Magnetic Field (80 A/m at 50 Hz):
<20 dB(A)

Effect of Humidity (at 40 °C, 1 kHz):
<0,5 dB sensitivity variation for 0 to 90 % R.H.

Vibration Sensitivity (10 Hz to 2 kHz):
Typically <76 dB equivalent sound pressure level for vibration level of 1 m/s² applied perpendicularly to microphone diaphragm. (Typically <64 dB equivalent SPL for 1m/s² tangential to diaphragm)

Power Supply:
Two 9 V alkaline batteries (IEC type 6LF22) or other 9 V batteries
Battery Life: Approx. 30 hours continuous operation with alkaline batteries.

Dimensions:
Overall Length: 252 mm (9,9 in)
Overall Width: 72 mm (2,8 in)
Depth: 23 mm (0,9 in)

Weight:
460 g (1 lb) with batteries

Accessories Included:

1 Half-inch Prepolarized Condenser Microphone	Type 4176
1 Windscreen	UA 0459
1 Random Incidence Corrector	DZ 9566
1 Leather Carrying Case	KE 0205
1 Protective Hood	DZ 9603
1 2,5 mm Mini-jack Plug	JP 0213

Accessories Available:

Portable Graphic Level Recorder	Type 2306
Sound Level Calibrator	Type 4230
Level Recorder Cable	AO 0173
Tripod	UA 0587
9 V Alkaline Batteries	QB 0016

2. CONTROLS

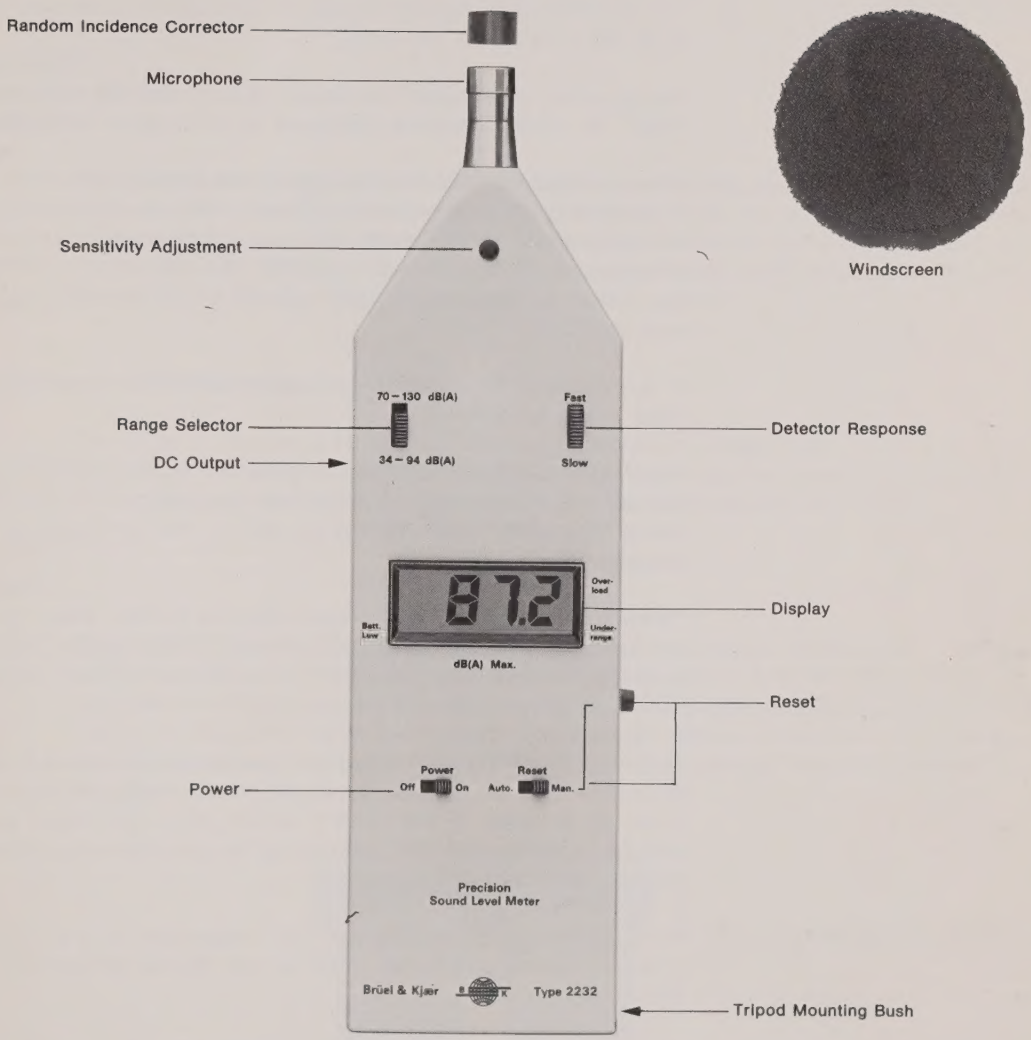


Fig. 2.1. Precision Sound Level Meter Type 2232

WINDSCREEN: Foam Windscreen UA 0459 for use in short-term outdoor measurement situations and dusty environments. The Windscreen reduces wind induced noise and protects the microphone from dust and light precipitation.

RANDOM INCIDENCE CORRECTOR: Placed over the microphone for free-field measurments in accordance with ANSI S1.4 – 1971 (and proposed revision) and for diffuse field measurements.

MICROPHONE: Half-inch diameter B & K Prepolarized Condenser Microphone Type 4176. Note that the protection grid fitted to this microphone cannot be removed.

POWER: Two-position slide switch for supplying power to the instrument. The 2232 is powered from two 9 V cells. For details of battery replacement procedure, see section 3.2.

RANGE SELECTOR: Two-position slide switch for selecting the desired measuring range: 34 to 94 dB(A) or 70 to 130 dB(A).

DETECTOR RESPONSE: Two-position slide switch for selecting the internationally standardized "Fast" or "Slow" detector response in accordance with IEC 651.

DISPLAY: 3½ digit, liquid crystal display with 0,1 dB display resolution. In addition to displaying the maximum A-weighted RMS sound pressure level measured, overload, underrange and low battery conditions are indicated. When power is supplied to the 2232, the display momentarily shows "$_{BAT}$ 188.8 ≎", allowing a quick check of all display segments. See section 3.5.3.

RESET: A two-position slide switch and push button for selecting the display reset mode as follows:

"Auto.": When the RESET slide switch is in the "Auto." position, the display is automatically updated every second and the maximum RMS sound pressure level measured during the preceeding second is displayed.

"Man.": When the RESET slide switch is in the "Man." position, the display is reset using the RESET button located on the right hand side of the instrument. The max. RMS value measured is displayed until the RESET button is pushed once more.

Note: To avoid erroneous results due to switch clicking, an overload indication ("– – – ▲") is displayed when changing from one switch mode to another. If the RESET switch is in the "Man." position, the display must be manually reset using the push button on the side of the 2232.

SENSITIVITY ADJUSTMENT: Variable capacitor adjustment for calibration of the 2232 using an external reference source such as the Sound Level Calibrator Type 4230. See section 3.4.

DC OUTPUT: 2,5 mm diameter mini-jack socket providing a DC voltage for use with level recorders such as the Portable Level Recorder Type 2306 (see section 3.5.5.). An output voltage of 0 to 3 V (positively increasing at 50 mV/dB) is obtained in both measuring ranges with 0 V corresponding to either 34 dB(A) or 70 dB(A). The socket output impedance is less than 10 Ω, and the maximum output voltage is 3 V. Minimum load impedance is 10 kΩ. Accepts 2,5 mm mini-jack plug JP 0213 which is provided.

TRIPOD MOUNTING BUSH: A UNC ¼″ × 20 threaded bush is located at the rear of the 2232 for tripod mounting.

3. OPERATION

3.1. PRELIMINARY

3.1.1. Introduction

This Instruction Manual describes the specific procedures necessary to use the Precision Sound Level Meter Type 2232 correctly. However, other more general aspects of sound measurements must be considered in order to be sure of accurate reproducible measurements. Many of these are discussed in the accompanying book "Measuring Sound" which should be read before proceeding with a measurement.

3.1.2. Environmental Considerations

The 2232 is designed to operate over a temperature range from –10 to +50 °C (+14 to +122 °C). When not in use, the Sound Level Meter should be stored in a warm dry place, preferably with the batteries removed if long term storage is considered.

3.2. POWERING

The 2232 is powered from two 9 V batteries which are located in the battery compartment at the lower end of the instrument. Alkaline batteries (B & K No. QB 0016) are recommended and, from new, will provide approximately 30 hours continuous operation. Before fitting or replacing batteries, ensure that the instrument is switched off. Access to the battery compartment is gained by sliding the battery compartment cover off as shown in Fig. 3.1.

Fig. 3.1. Battery replacement

The batteries should be replaced when the "BAT" indication appears in the lower left hand corner of the display, as shown in Fig. 3.2. Although the Type 2232 will continue to measure accurately for a short period after the battery replacement indication is given, it is good practice to replace the batteries immediately to avoid any possibility of erroneous results.

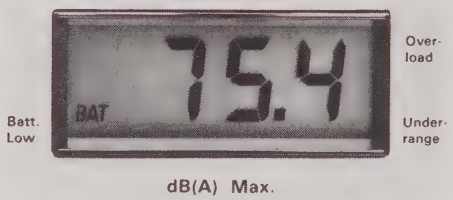


Fig. 3.2. Low battery indication shown on the 2232 display

3.3. MOUNTING THE MICROPHONE

Before connecting or disconnecting the microphone, ensure that the instrument is switched off. Light finger torque only should be used when screwing the microphone onto the fixed input stage adaptor. In dry weather, it is recommended that static electricity is discharged from the body before fitting or removing the microphone.

Note: The microphone protection grid is not removable. A fine wire gauze filter inside the protection grid prevents dust and particle penetration to the diaphragm.

3.4. CALIBRATION

The Type 2232 is calibrated acoustically using an external reference source such as the Sound Level Calibrator Type 4230 which is placed over the microphone. The 4230 generates a stabilised sound pressure level of 94 dB (±0,3 dB) at a frequency of 1 kHz. The calibration procedure is as follows:

1. Remove the Windscreen and Random Incidence Corrector, if fitted.

2. Remove the small plastic plug from the front panel of the Type 2232, directly below the microphone, giving access to the SENSITIVITY ADJUSTMENT trimmer.

3. Set the controls on the 2232 as follows:

RANGE SELECTOR:	"70 – 130 dB(A)"
DETECTOR RESPONSE:	"Fast"
RESET:	"Auto."
POWER:	"Off"

4. Place the Sound Level Calibrator over the microphone and turn it on.

5. Switch the Type 2232 on. The display momentarily shows "BAT 188.8 ⇕". This is a display function check.

6. Using a small screwdriver, adjust the SENSITIVITY ADJUSTMENT trimmer to obtain a reading of 93,8 dB(A) on the sound level meter display.

Fig. 3.3. Calibration of the 2232 using the Sound Level Calibrator Type 4230

7. Remove the calibrator gently and replace the plastic plug over the adjustment trimmer.

The Sound Level Meter is now calibrated and ready for use. Although the calibration stability is good and the instrument should require only periodic adjustment, it is recommended that a calibration check is performed before commencing with a measurement. This check is easily made following steps 3 to 5 above. The 2232 display should show a level of 93,8 (A).

3.5. SOUND LEVEL MEASUREMENTS

3.5.1. General

The accompanying booklet "Measuring Sound" should be read before proceeding with measurements as it contains much useful information on the subject. Always use the supplied Windscreen when measurements are made outdoors or in very dusty environments. Ensure the background noise level is low enough to obtain valid measurement results. To minimise disturbances of the sound field due to the operator's body, the Sound Level Meter should be held firmly at arms length or, preferably, mounted on a tripod.

3.5.2 Considerations Regarding the Type of Sound Field

The condenser microphone fitted to the Type 2232 is designed to have a linear free field response for 0° incidence, i.e. absolute or reference accuracy is obtained when the microphone is pointed directly at a sound source under free field conditions. Use of the supplied Random Incidence Corrector DZ 9566 results in a linear response under diffuse field conditions.

IEC Standards:
When performing measurements requiring the use of a sound level meter to IEC standards the Random Incidence Corrector DZ 9566 should NOT be mounted on the microphone.

When performing measurements to national and international recommendations, the sound level meter should be used as prescribed in the relevant standard. In general, the sound level meter should be pointed directly at the source if a free field condition is assumed to exist (Fig. 3.4(a)), e.g. outdoor measurements, indoor measurements of single sources or in absorbent rooms. In a diffuse field the sound level meter may be orientated in any direction.

ANSI Standards:
When performing measurements requiring the use of a sound level meter to ANSI standards the "free field" microphone's characteristics should be adapted to a linear random incidence response by mounting the Random Incidence Corrector DZ 9566. This applies for measurements in all types of sound field.

In a truly diffuse field, the sound level meter can be oriented in any direction in the sound field. Under ideal free field conditions optimum response is obtained by orientating the sound level meter as shown in Fig. 3.4(b).

Measurements not requiring the use of an IEC or ANSI sound level meter

For measurements in a free field, the Random Incidence Corrector DZ 9566 should NOT be mounted on the microphone. The meter should be pointed directly at the sound source during measurements.

For measurements in a diffuse field the Random Incidence Corrector DZ 9566 should be mounted on the microphone. The meter may be oriented in any direction in the diffuse field.

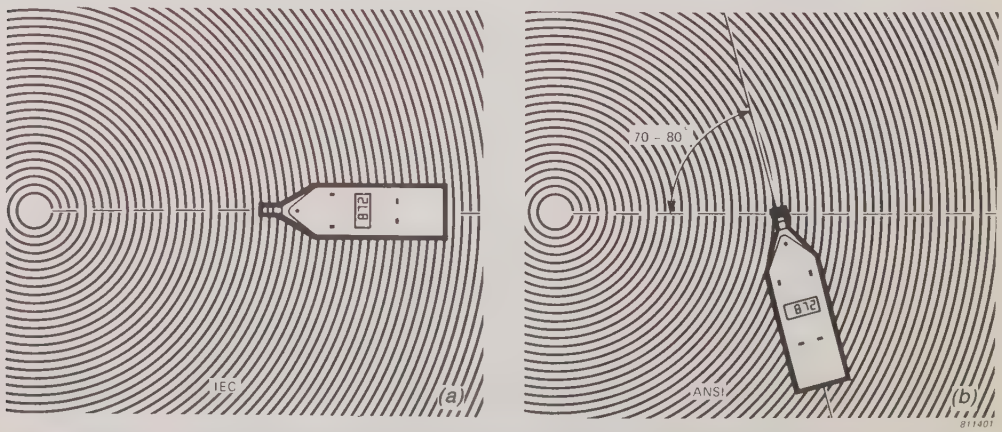


Fig. 3.4. Optimum orientation of the Type 2232 for free field measurements (a) where the use of a Sound Level Meter to IEC standards is called for, and (b) where the use of a Sound Level Meter to ANSI standards is called for

3.5.3. Display Functions

In addition to displaying the measured sound pressure level, the digital display on the 2232 gives an indication of low battery ("BAT"), overload ("– – – ▲") and underrange ("– – – ▼") conditions as shown in Fig. 3.5.

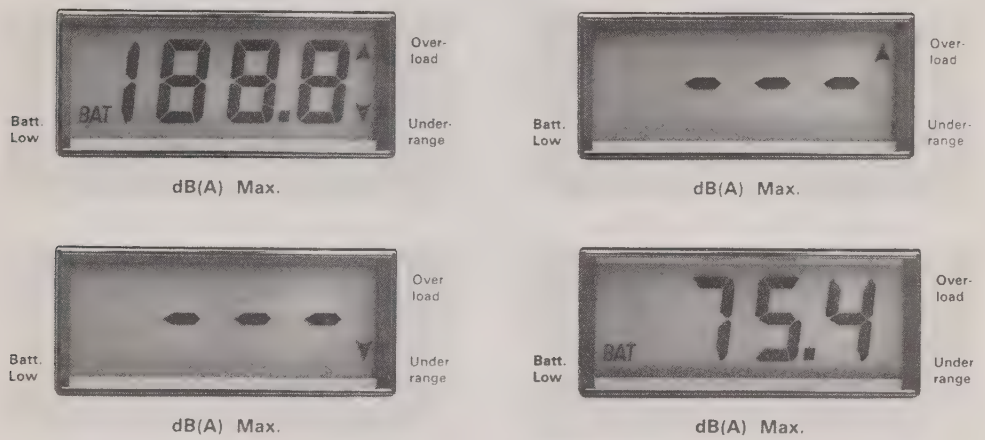


Fig. 3.5. Display check, overload, underrange and low battery indications

Display Check "BAT 188.8 ▲▼":
When power is first supplied to the instrument, this indication is momentarily displayed to show that all display segments are operative.

Overload "– – – ▲":
This indication is displayed when the measured sound pressure level exceeds the upper limit of the selected measurement range. Note that the overload indication is also displayed when changing from one switch setting to another to avoid erroneous readings due to switch noise. In the "Auto." RESET mode the display is reset every second and the measurement is resumed. When using the "Man." RESET mode, however, the overload indication is held and the display must be manually reset to resume measurement.

Underrange "– – – ▼":
The underrange indication is displayed when the sound pressure level is below the lower limit of the selected measurement range.

Low Battery "BAT":
This is displayed in the lower left corner of the display when the batteries must be replaced.

3.5.4. Procedure for Sound Level Measurements

1. Check the calibration validity using the Sound Level Calibrator Type 4230 as described in section 3.4.

2. Set the RANGE SELECTOR switch to the appropriate measuring range for the proposed measurement.

3. Set the DETECTOR RESPONSE switch as follows:

"Fast":	For relatively steady sound levels.
"Slow":	For rapidly fluctuating sound levels.

4. Select "Auto." or "Man." RESET mode, as required.

"Auto.":	Resets automatically every second and displays the max. RMS value measured during the preceeding second.
"Man.":	For a single "max. hold" reading of an event. The display is reset when the RESET push button is pressed and thereafter updates and holds the maximum value measured until the next manual reset.

Note: If the overload indication is displayed in the "Man." mode, the display must be manually reset to resume measurement.

5. Switch the instrument on. The display function check and overload condition are shown.

6. Note the displayed value, eg. 70dB(A) fast.

For DC recording using the DC output, see section 3.5.5.

3.5.5. Use With Portable Graphic Level Recorder Type 2306

For recording purposes, the Portable Graphic Level Recorder Type 2306 is well suited for use with the 2232, giving the advantage of a hard-copy time history of the measured sound pressure level. The DC OUTPUT on the 2232 provides a continuous DC voltage which is proportional to the A-weighted "Fast" or "Slow" RMS sound pressure level measured. The output voltage ranges from 0 to 3 V in both measuring ranges with 0 V corresponding to the lowest limit of the range (34 or 70 dB(A) respectively). The DC ouput from the 2232 is connected to the SIGNAL INPUT socket of the 2306 using a 2,5 mm jack-to-BNC cable (B & K No. AO 0173). The calibration and measurement procedure is as follows:

1. Check the 2232 calibration validity as detailed in section 3.4.

2. Load the Level Recorder with suitable recording paper (QP 0102), switch on and check the BATTERY indicator (see the Instruction Manual for the 2306).

3. Connect the DC OUTPUT of the 2232 to the SIGNAL INPUT of the 2306 using cable AO 0173.

4. Set the RECORDING MODE switch on the 2306 to "DC Lin.", set the POLARITY switch to "Ground" and turn the SENSITIVITY control to its "0" position.

5. Switch the PEN DRIVE on and select a writing speed/low frequency limit for the recording ("250 mm/s – 25 Hz" is suitable).

6. Using the DC LIN. POSITION potentiometer, move the recorder pen to the thick line at the bottom of the recording paper. This corresponds to the lower limit of the measuring range on the 2232 (70 dB(A) during calibration procedure).

Fig. 3.6. DC Level Recording using the Portable Graphic Level Recorder Type 2306

7. Set the POLARITY switch of the 2306 to "+".

8. Set the controls on the 2232 as follows:

RANGE SELECTOR:	"70 – 130 dB(A)"
DETECTOR RESPONSE:	"Fast"
RESET:	"Auto."
POWER:	"Off"

9. Place the Sound Level Calibrator Type 4230 over the microphone and switch it on.

10. Switch the Type 2232 on. The function check and overload indication are momentarily displayed.

11. Adjust the SENSITIVITY potentiometer on the Level Recorder to obtain a deflection corresponding to 93,8 dB(A) as shown in Fig. 3.7.

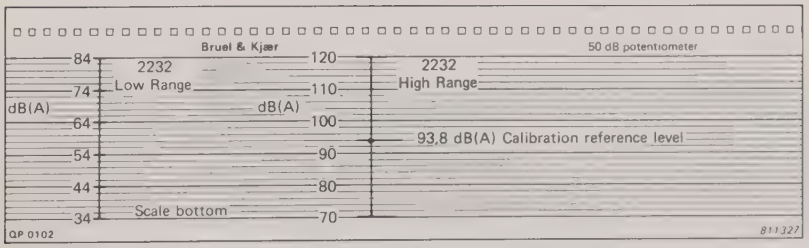


Fig. 3.7. Calibrating the Type 2306. The thick line at the bottom of the paper corresponds to 70 dB(A), giving a recording range of 70 to 120 dB(A) (or 34 to 84 dB(A)) with a 50 dB potentiometer fitted to the Type 2306

12. Set the POLARITY switch of the 2306 to "Ground" and repeat steps 6 to 11. This will compensate for any interaction between the DC LIN. POSITION and SENSITIVITY controls, improving the accuracy of the calibration.

13. Remove the Calibrator gently.

The Level Recorder is now calibrated and ready for use. Set the controls on the Type 2232 as required for the proposed measurement (see section 3.5.4.). Note that the thick line at the bottom of the recording paper corresponds to the lower limit of the chosen measuring range (i.e. either 70 dB(A) or 34 dB(A)). To begin recording choose a suitable paper speed, position the pen over the required starting point and switch the Level Recorder paper drive on.

Some users may wish to calibrate the level recorder so that the thick lines on the paper chart represent tens of dB(A) when using the 34 to 94dB(A) range of the 2232. The calibration procedure for this is the same as above except in Step 6. the recorder pen is adjusted to lie two lines above the scale bottom, and in Step 11. the recorder pen is adjusted to lie 14 lines above the scale bottom. Fig. 3.8. shows the two scales obtained with this alternative calibration procedure. Note that the lowest 4 dB of the scales are out of range in this case.

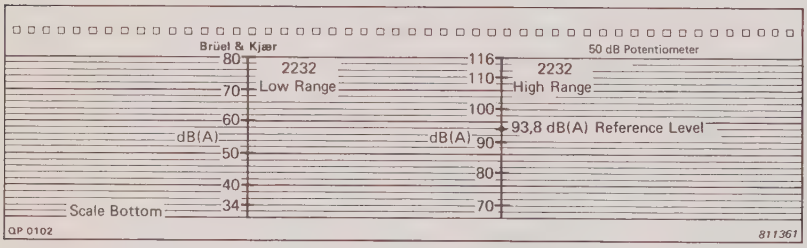


Fig. 3.8. Alternative calibration of the Level Recorder Type 2306 to obtain tens of dB(A) on the thick lines of the scale when recording in the low (34 to 94 dB(A)) range of the 2232.

Recordings of various noise sources using different operating modes of the 2232 are shown in Figs. 3.9. to 3.11. Fig. 3.10. shows the noise recorded from a punch-press, illustrating the difference obtained using different detector weightings and paper speeds. In Fig. 3.11. the time history of a vehicle pass-by is shown. Using the "Man." RESET mode allows an overall maximum value to be obtained on the digital display in addition to the continuous recording shown.

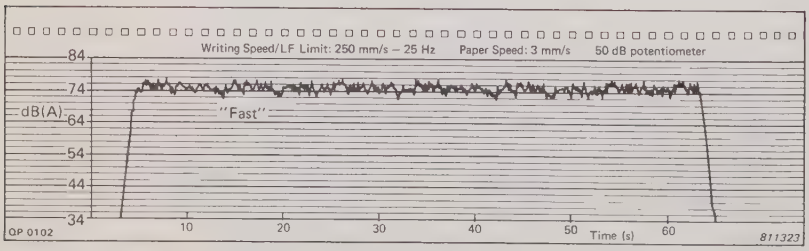
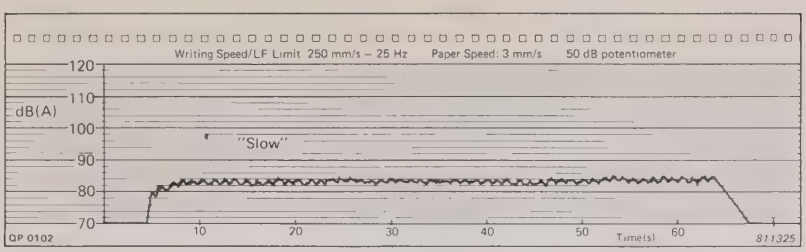
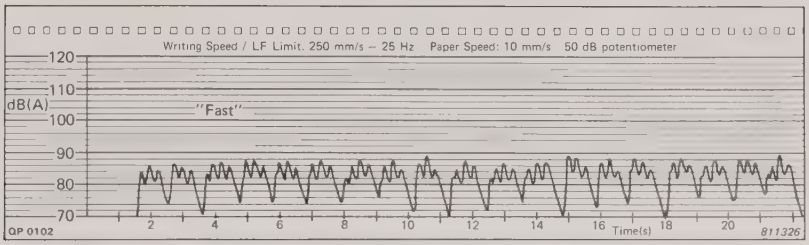


Fig. 3.9. Machine noise recorded using the "Fast" detector characteristic



(a)



(b)

Fig. 3.10. Recording of noise from a punch-press using: a) "Slow" detector characteristic and b) "Fast" detector characteristic

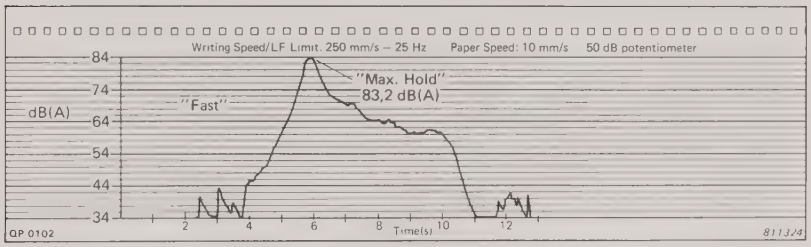


Fig. 3.11. Recording of single event traffic pass-by noise from a motor vehicle. In the "Man." RESET mode a max. value of 83,2 dB(A) is obtained on the digital display

4. CHARACTERISTICS

4.1. INTRODUCTION

Many of the characteristics of the Precision Sound Level Meter Type 2232 are specified in Chapter 1. For brevity these are not repeated.

The block diagram for the Type 2232 is shown in Fig. 4.1. In general a sound level meter consists of a microphone, an amplifier with defined frequency weighting and a detector – indicator with associated time weighting characteristics. The Type 2232 is equipped with a high sensitivity (50 mV/Pa) half-inch prepolarized condenser microphone Type 4176. An overload detector monitors the signal level both before and after filtration. The signal is then fed to an LMS (Log. Mean Square) detector with selectable "Fast" and "Slow" response in accordance with IEC 651. A DC voltage output is available at this stage which is analogue to the measured RMS sound pressure level. The signal is then digitised and sampled. A timer and max. hold circuit process the digitised signal to give a max. RMS value readout on the display every second. In the manual display-reset mode the current value is compared with the preceeding readout and the display is only updated when the preceeding value is exceeded, thus providing a Max. Hold function.

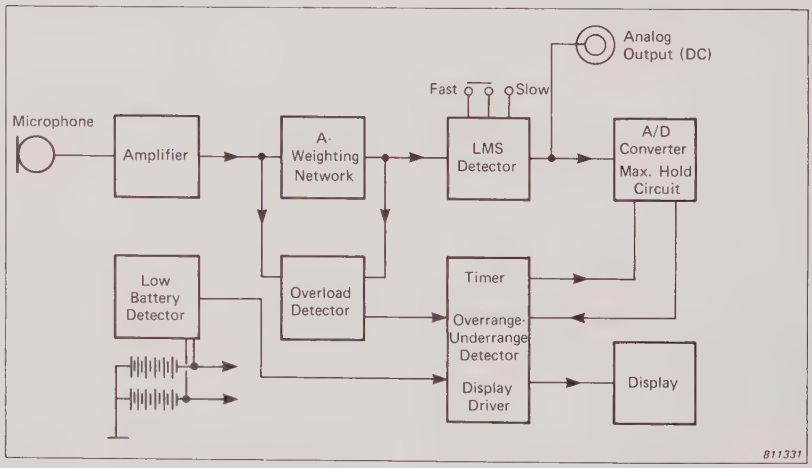


Fig. 4.1. Block diagram of the Precision Sound Level Meter Type 2232

4.2. FREQUENCY RESPONSE CHARACTERISTICS

The frequency response of the complete instrument relative to the theoretical A-weighting curve and the relevant IEC and ANSI limits is shown in Figs. 4.2 and 4.3.

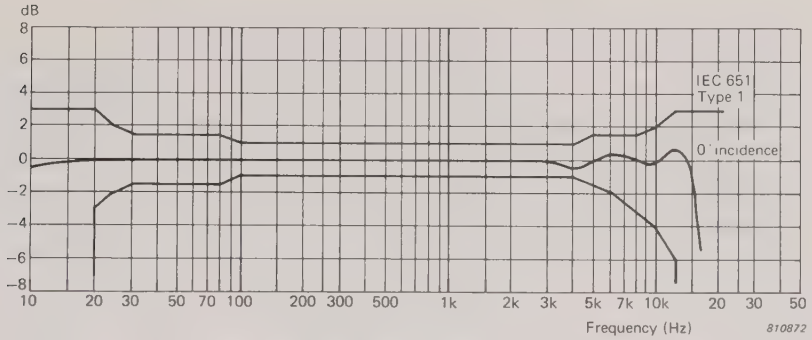


Fig. 4.2. Typical free-field frequency response of the complete instrument to sine waves with 0° incidence. (shown as a deviation from the theoretical A-weighting curve)

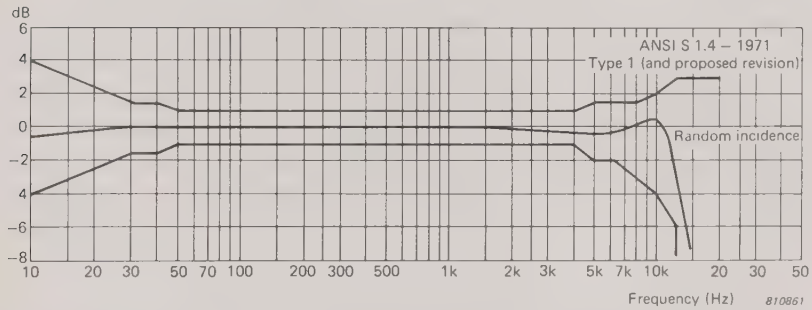


Fig. 4.3. Typical diffuse-field frequency response of the complete instrument with the random incidence corrector fitted. (shown as a deviation from the theoretical A-weighting curve)

4.3. DIRECTIONAL CHARACTERISTICS

Directional characteristics of the complete instrument at various frequencies in a free field are shown in Fig .4.4.

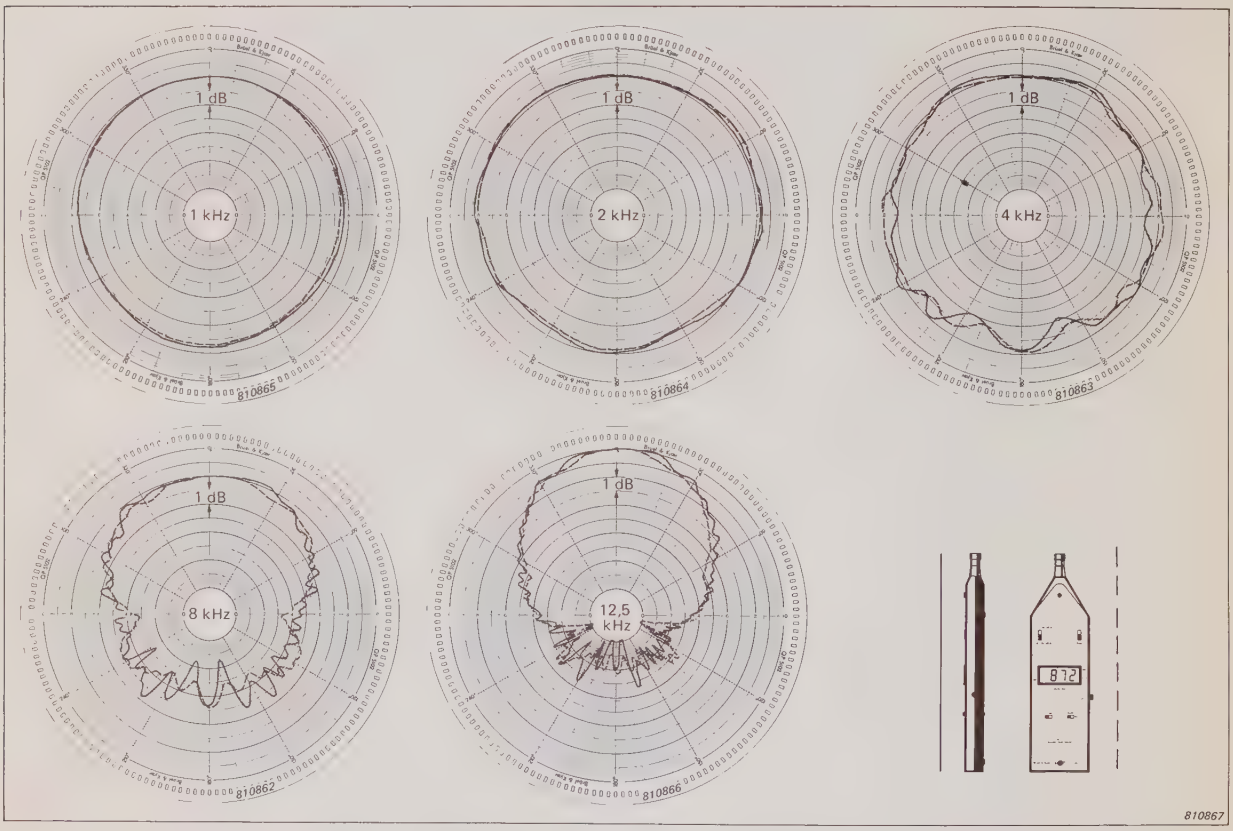
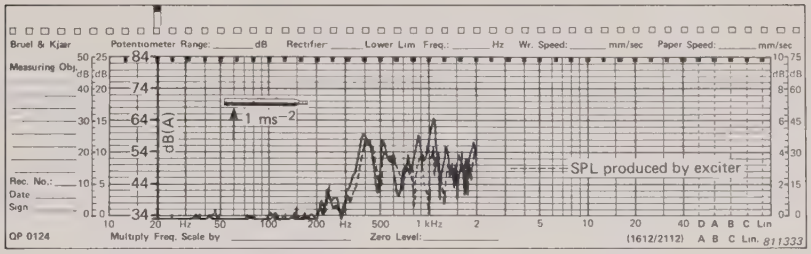


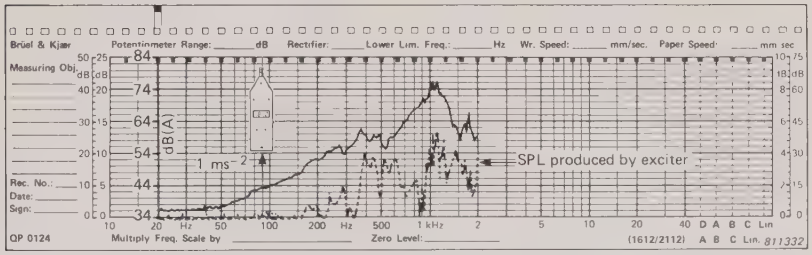
Fig. 4.4. Directional characteristics of the complete instrument in a free field

4.4. VIBRATION SENSITIVITY

Fig. 4.5 shows the sound level registered by the 2232 when subjected to vibration in a direction perpendicular (Fig. 4.5 a) and tangential (Fig. 4.5 b) to the the microphone diaphragm. Noise, from the vibration exciter used to perform the test, is plotted as a broken line.



(a)

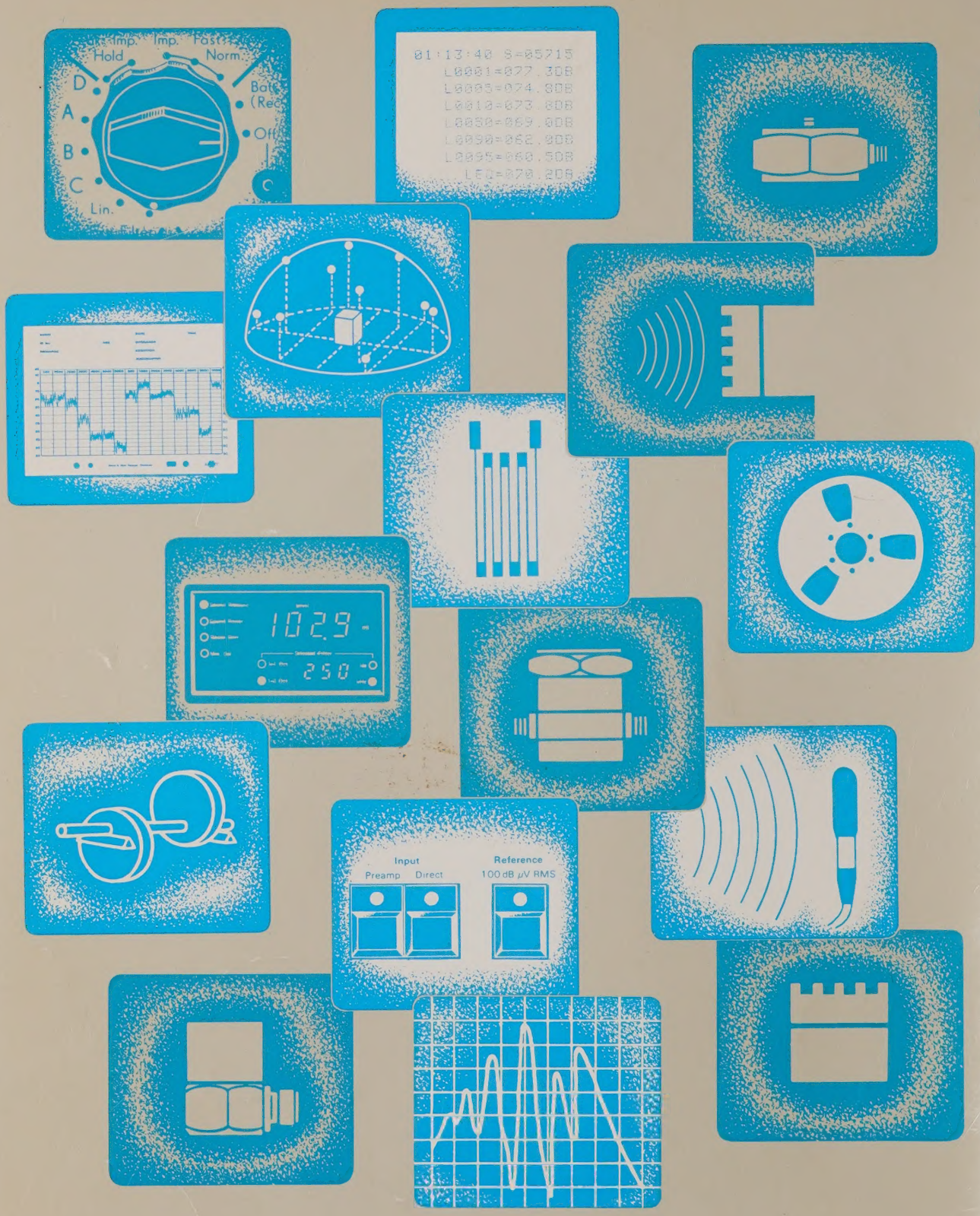


(b)

Fig. 4.5. Equivalent SPL (dB(A)) when the complete sound level meter is subjected to a vibration level of 1 ms^{-2}. (a) Horizontally, and (b) Vertically

5. SERVICE AND REPAIR

The Precision Sound Level Meter Type 2232 is designed and constructed to provide the user with many years of trouble free operation. However, should a fault occur which impairs its correct function, the batteries should be removed and the instrument secured against unintended operation. For repair, consult the separate Service Instruction Manual available for the Type 2232, or contact your local B & K service representative.



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